PRINCETON
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# Ronald E. Hatcher
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## *Using Physics and Chemistry to Understand the Genome*


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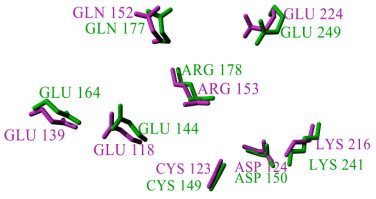
**ABSTRACT:**
The sequencing of the genome, the complete DNA, for humans and for thousands of other species at the dawn of the new millennium brought promises of untold advances in medicine and of many other novel technologies of benefit to the world. However, big questions remain about the roles played by these DNA sequences, including many of the protein-coding genes. Structural Genomics (SG) projects have since determined the 3D structures of over 13,500 gene products, but most of them are of unknown or uncertain function. In order to transform the promises of genome science into useful and practical advances, we must understand the function of these protein gene products. Therefore, discovering the function of protein 3D structures is an important current problem. A new approach to this problem is described based primarily on chemical and electrostatic properties computed using techniques from chemical physics. Our function prediction method utilizes electrical potential functions that we calculate from the protein 3D structure. These potential functions are in turn used to predict the amino acids that are involved directly in the protein's function. For proteins of known function, these sets of amino acids are used to establish "chemical signatures" for each functional type. Then, we predict the sets of active amino acids for protein structures of unknown function and, using matching with the chemical signatures, seek a functional assignment for the proteins of unknown function. Biochemical experiments are then performed to test whether our function prediction is correct.


**BIOGRAPHY:**
**Dr. Mary Jo Ondrechen** earned her Bachelor's degree from Reed College, Portland, Oregon and the Ph.D. degree in Physical Chemistry and Chemical Physics from Northwestern University, Evanston, Illinois. After postdoctoral research appointments at the University of Chicago and at Tel-Aviv University in Israel, the latter as a NATO Postdoctoral Fellow, she joined the faculty at Northeastern University in Boston, Massachusetts in 1980. Currently she is Professor of Chemistry and Chemical Biology and also the Principal Investigator of the Computational Biology Research Group at Northeastern University.

Her current research activities include modeling of biological macromolecules, understanding enzyme catalysis, development of predictive theory for functional genomics, and computational guidance of drug design. Members of her research team are studying the role of remote residues in enzyme catalysis and in predicting the function of Structural Genomics proteins of unknown function. Her group also performs the computational modeling for ongoing drug discovery projects, including the design of novel therapies to treat antibiotics-resistant infections and for the design of novel agents for detecting and imaging early-stage cancer.

Professor Ondrechen is also a community leader and activist. She recently served on the Board of Advisors of the Washington, DC-based Interstate Technology and Regulatory Council (ITRC). She is President of the Board of Directors of the North American Indian Center of Boston (NAICOB) and was the 2011-2013 Chair of the Board of Directors of the American Indian Science and Engineering Society (AISES). She is active in promoting higher education and careers in science and research to young people, particularly in minority communities. She also actively promotes the use of innovative technologies to solve environmental problems.

A proud member of Mohawk Nation of the Iroquois Confederacy, she enjoys running and traditional cooking.